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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NO.
MANSEL (PCT)

U.S. APPLICATION NO. (if known, see 37 CFR 1 5)
09/831974

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/03620	14 NOVEMBER 1999	16 NOVEMBER 1998

TITLE OF INVENTION
METHOD AND DEVICE FOR DISCOVERING AND LOCALIZING UNDESIRABLE RADIO EMISSIONS

APPLICANT(S) FOR DO/EO/US
DETLEF MANSEL (PCT)

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. X This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ___ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. X This is an express request to begin national examination procedures (35 U.S.C. 371 (f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. X A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. X A copy of the International Application as filed (35 U.S.C. 371(c)(2)
   a. X is transmitted herewith (required only if not transmitted by the International Bureau)
   b. ___ has been transmitted by the International Bureau.
   c. ___ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. X A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ___ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ___ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ___ have been transmitted by the International Bureau.
   c. ___ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ___ have not been made and will not be made.
8. ___ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. X An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ___ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. X An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ___ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. X A **FIRST** preliminary amendment.
    ___ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ___ A substitute specification.
15. ___ A change of power of attorney and/or address letter.
16. X Other items or information:

    PCT/ISA/210 - Int'l. Search Report (English)
    3 sheets of formal drawings

Applicant Claims Priority under 35 U.S.C. §119 of German Application No. 198 52 715.2 filed November 16, 1998.
Applicant Claims Priority under 35 U.S.C. §120 of: PCT/DE99/03620 filed November 14, 1999.

APPLICATION NO. (if known, see 37 CFR 1.5) 09/831974	INTERNATIONAL APPLICATION NO. PCT/DE99/03620	ATTORNEY'S DOCKET NO. MANSEL (PCT)
	CALCULATIONS	PTO USE ONLY

X The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO.....**$860.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) **$690.00**

Neither international preliminary examination fee paid (37 CFR 1.82) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....**$1,000.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....**$100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT = $ 860.00

Surcharge of **$130.00** for furnishing the oath or declaration later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

Claims	Number Filed	Number Extra	Rate	
Total Claims	29 - 20 =	- 9 -	X **$18.00**	$ 162.00
Independent Claims	1 - 3 =	- 0 -	X **$80.00**	$
Multiple dependent claim(s) (if applicable)			+ **$270.00**	$
TOTAL OF ABOVE CALCULATIONS =				$ 1,022.00
Reduction by 1/2 for Small Entity status.				$ 511.00
SUBTOTAL =				$ 511.00
Processing fee of **$130.00** for furnishing the English translation later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$
TOTAL NATIONAL FEE =				$ 511.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				
TOTAL FEES ENCLOSED =				$ 511.00
			Amount to be: refunded	$
			charged	$

a. X Applicant claims Small Entity status.

a. X A check in the amount of $ 511.00 to cover the above fees is enclosed.

b. ___ Please charge my Deposit Account No. 03-2468 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. 03-2468. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
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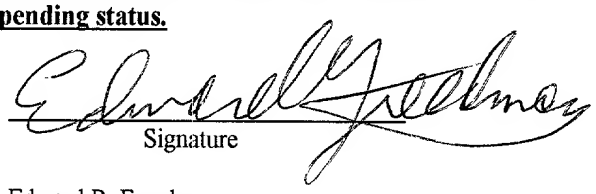

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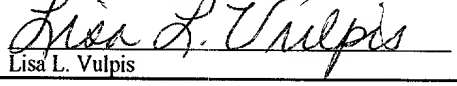
Edward R. Freedman
Reg. No. 26,048

Express Mail No. **EL 769 391 441 US**
Date of Deposit **May 16, 2001**

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10, on the date indicated above, and is addressed to the Ass't. Commissioner for Patents, Washington, D.C. 20231



Lisa L. Vulpis

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: DETLEF MANSEL (PCT)

PCT NO.: PCT/DE99/03620

FILED: NOVEMBER 14, 1999

TITLE: METHOD AND DEVICE FOR DISCOVERING AND LOCALIZING UNDESIRABLE RADIO EMISSIONS

PRELIMINARY AMENDMENT

BOX PCT
Ass't. Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Preliminary to the initial Office Action, please amend the above-identified application as follows:

IN THE SPECIFICATION:

On Page 1, after the title and before line 1, please insert the following paragraphs:

--CROSS REFERENCE TO RELATED APPLICATIONS

Applicant claims priority under 35 U.S.C. §119 of German Application No. 198 52 715.2 filed November 16, 1998. Applicant also claims priority under 35 U.S.C. §120 of PCT/DE99/03620 filed November 14, 1999. The international application under PCT article 21(2) was not published in English.--

On Page 3, line 17, before "Object of this invention", insert the following paragraph:

--In WO 96 42020 A a procedure is described, in which by means of an arrangement of antennas with a downstream evaluation unit a received signal of a cellular phone or something like is localized with respect to the position of the cellular phone. This shall serve for the rescue of persons out of dangerous situations or the like. The signals of a cellular phone are therefore received by a number of antennas, positioned within the localisation area with well known positions, in which case for example by runtime measurements of the received signals at each antenna and a respective evaluation in a neural network an accurate localisation of the cellular phone is caused. First of all a training phase is carried out before with the aid of a measuring vehicle or a cellular phone in motion, during which permanent measurements of emitted signals of the cellular phone or the measuring vehicle are carried out, in which case the respective position of the cellular phone or the measuring vehicle is exactly known. By these means it is possible, that so-called reference signals for typical positions of cellular phones are determined first of all, with which signals of cellular phones of unknown position in operating state can be compared. This comparison is then carried out with the help of a neuronal network, which does the elimination of receiving faults and a synchronisation of the received signals of different antennas.--

IN THE CLAIMS:

Please cancel claims 1-31 and replace them with new claims 32-60 as follows:

--32. Method for the uncoverage and the local enclosure of unwanted radio transmissions (5, 12, 19), for example unwanted telephony with mobile radiotelephones, in which with at least one radio receiver (2) with an antenna, which can be influenced in respect of their receiving properties, a surrounding area of the radio receiver (2) is examined for the existence of radio transmissions (5, 12, 19), in which at least one initial training phase is carried out, during which by means of changing locally allocation between a reference emitting device for radio transmissions (5, 12, 19) and the radio receiver (2) representations of emitted and locally known reference radio transmissions are recorded,

characterized in that

at least a first measurement phase is carried out, during which the surrounding area is scanned fast and with less accuracy by the radio receiver (2) for the existence of unwanted radio transmissions (5, 12, 19) and by recognition of unwanted radio transmissions (5, 12, 19) in a secondary measurement phase a representation of the unwanted radio transmission (5, 12, 19) is

determined, for what the registered unwanted radio transmission (5, 12, 19) is measured with more accuracy, and

during existence of unwanted radio transmissions (5, 12, 19) an evaluation phase follows, in which the representations recorded during initial training phase and the representation of the recorded radio transmissions (5, 12, 19) are compared with each other and there from an information about the local position of the emitting device (6, 13, 17) of the unwanted radio transmissions (5, 12, 19) in the surrounding area is evaluated.

33. Method as claimed in claim 32, characterized in that the surrounding area is scanned totally or partially by the radio receiver (2) for unwanted radio transmissions (5, 12, 19).

34. Method as claimed in claim 32, characterized in that the recognized unwanted radio transmission (5, 12, 19) is measured with higher resolution of the radio receiver (2).

35. Method as claimed in claim 34, characterized in that the recognized unwanted radio transmission (5, 12, 19) is measured with higher resolution by a change of the directive efficiency of the radio receiver (2).

36. Method as claimed in claim 32, characterized in that the measurement signals of the secondary measurement phase at

registering an unwanted radio transmission (5, 12, 19) phase are transmitted to a evaluation device, in which the measurement signals are evaluated in form of a one-dimensional or two-dimensional representation of the radio transmission (5, 12, 19).

37. Method as claimed in claim 36, characterized in that the representation of the radio transmission (5, 12, 19) is compared for correspondences with the representations recorded in the initial training phase.

38. Method as claimed in claim 36, characterized in that the comparison of the representation recorded in the initial training phase and the representation of the radio transmission (5, 12, 19) is carried out by means of methods of pattern recognition and/or image analysis.

39. Method as claimed in claim 36, characterized in that as methods of pattern recognition and/or image analysis fuzzy techniques are employed.

40. Method as claimed in claim 36, characterized in that the representation recorded in the initial training phase, which comes closest to the representation of the radio transmission (5, 12, 19), as well as the local position of the reference radio transmission known by the initial training phase are used as information for the local position of the emitting device (6, 13,

17) of the unwanted radio transmission (5, 12, 19) in the surrounding area.

41. Method as claimed in claim 40, characterized in that in case of evaluation of the local position of the emitting device (6, 13, 17) of a unwanted radio transmission (5, 12, 19) in a part of the surrounding area, in which radio transmission are unwanted, the evaluation device automatically alarms the operating personnel.

42. Method as claimed in claim 40, characterized in that in case of evaluation of the local position of the emitting device (6, 13, 17) of a unwanted radio transmission (5, 12, 19) in a part of the surrounding area, in which radio transmission are tolerated, the alarm for the operating personnel is suppressed.

43. Method as claimed in claim 36, characterized in that the closest representation recorded during the initial training phase and the representation of the unwanted radio transmission (5, 12, 19) are examined for the degree of correspondence by means of different features.

44. Method as claimed in claim 36, characterized in that additional information coming from the unwanted radio transmission (5, 12, 19), preferably signal runtimes, time offset while channel switching or the like, are used as further

information during evaluation of the signals of the radio receiver (2) in the evaluation device.

45. Method as claimed in claim 32, characterized in that the signals of more than one radio receiver (2) are evaluated in the evaluation device and are connected to a common representation of the radio transmission (5, 12, 19).

46. Method as claimed in claim 32, characterized in that for common radiotelephony devices, so-called cellular phones, for the evaluation of the representation also the radio transmissions (5, 12, 19) of such radiotelephony devices in the so-called stand-by mode are used for determining the local position of the radiotelephony device.

47. Method as claimed in claim 46, characterized in that for determining the local position of such radiotelephony devices in the so-called stand-by mode the radio transmissions (5, 12, 19) of the clock-pulse controlled switching online or offline the receivers of the radiotelephony devices is used.

48. Method as claimed in claim 46, characterized in that the method also serves for determining the local position of unspecific radio transmissions (5, 12, 19) of common electrotechnical devices, preferably so-called notebooks, CD-players or the same, which set free noise fields of a high frequency kind.

49. Method as claimed in claim 32, characterized in that at recognising multiple simultaneous radio transmissions (5, 12, 19) of different unwanted emitting device (6, 13, 17) a special treatment of the measurement signals of the radio receiver (2) is carried out, in which the signals are treated separately.

50. Method as claimed in claim 32, characterized in that the radio receiver (2) and/or the reference emitting device are moved on a respective to their position known path during the initial training phase and the radio receiver (2) records at known spots of this path reference radio transmissions.

51. Method as claimed in claim 32, characterized in that the initial training phase is carried out unique or after longer time intervals und the so developing representations of typical radio transmissions (5, 12, 19) are stored.

52. Method as claimed in claim 51, characterized in that the initial training phase is carried out each time, when the conditions of the surrounding area of the radio receiver (2) have changed significantly, preferably have changed seasonal.

53. Device for implementation of the method according to claim 32, showing at least one radio receiver (2) with a receiving device, which can be influenced in respect of their receiving properties,

characterized in that

the receiving device shows a directional antenna.

54. Device as claimed in claim 53, characterized in that the radio receiver (2) is influencable in his directive efficiency and/ or his resolution.

55. Device as claimed in claim 53, characterized in that the directive efficiency of the receiving device is controllable about at least a part of the total ball surface surrounding the receiving device.

56. Device as claimed in claim 53, characterized in that the change of the directive efficiency of the receiving device is caused mechanically or electrically.

57. Device as claimed in claim 53, characterized in that the change of the directive efficiency is influencable by a swivel of the receiving lobe or of the receiving minimum or by a method of radiogoniometrical techniques.

58. Device as claimed in claim 53, characterized in that the radio receiver (2) is coupled by signals with an evaluation device, to which the signals of the received unwanted radio transmissions (5, 12, 19) are transmitted.

59. Device as claimed in claim 58, characterized in that when several radio receivers (2) are used all signals of the received unwanted radio transmissions (5, 12, 19) are transmittable to a common evaluation device.

60. Device as claimed in claim 58, characterized in that the evaluation device is built by usage of a standard computer or the same.--

REMARKS

By this Preliminary Amendment, the application has been amended to conform with U.S. practice, the cross-reference to related applications has been inserted on page 1, a paragraph has been inserted on page 3 and claims 1-31 have been replaced by new claims 32-60. No new matter has been introduced. Entry of this amendment is respectfully requested.

Respectfully submitted,
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Lisa L. Vulpis

Method and device for the uncoverage and the local enclosure of unwanted radio transmissions

Description

The invention refers to a method and a device for the uncoverage and the local enclosure of unwanted radio transmissions, for example unwanted telephony with mobile radiotelephones, according to the precharacterising part of claim 1.

Radio transmissions are not permissible in all spheres of life. Examples for unallowed spheres are jails (because of safety against unallowed agreements and so on), but also aircrafts, hospitals (each because of electromagnetic compatibility EMC) or other spheres (defense of disturbance as for example in restaurants or the like). In theses spheres a unallowed radio transmission must be recognized reliably and sufficiently locally assigned, so that a drafty turning off of the device und perhaps a taking away is possible. For this instance the device must by no means be conceived as a radio set. Also a lot of other devices, such as so-called notebooks and CD-players, disturbe because of the therein used high clock frequencies.

Mobile radiotelephones (for example so called "cellular phones") send out during telephoning and during organizational processes (for example checking in in a cellular net) high frequency energy. The respective radio network (for example GSM, DECT, Tetra) shows their characteristic features in the tuning area and in the time domain, through which the radio transmission can be assigned. Other devices (see above) send out as an undesired side effect high frequency energy with characteristic features.

A first group of known devices for recognizing unwanted radio transmissions reacts to radio transmissions in an interesting tuning area by means of an acoustical/ optical/ electrical alarm. Higher-classed, especially for radiotelephones conceived devices analyse the radio transmissions for further characteristics (for example in the time domain) for minimizing spurious alarms (for example "Mobifinder" of the german company MAZ, published in the german magazine VfS (Verband für Sicherheitstechnik), Fachinformation 2/98, pages 8-11).

These devices show the drawback to search for relay line sections in the surrounding area regardless of the direction. The size of the scanned area depends on the sensitivity of the reciever, the transmitted energy (which can vary very much in modern transmission systems, because it may be adaptively adjusted) and on the propagation of waves, which is very complex and little predictable. Therefore an alarm is locally such unspecific, that a localisation of the device emitting high frequency radiation after triggering an alarm is very difficult. On the other hand, quite a lot of devices with a very small recieving area must be used, which is difficult to insure in the view of radio technology an economically dubious.

A second group of devices, again especially for mobile radiotelephones, disturbs the organisational channel of the respective network (for example devices of the company Netline, device C-Guard Cellular firewall), so that there isn´t possible any log in. As a further idea the simulation of a base station exists for detecting possible mobile radiotelephones by inquiry in a limited area.

These devices are developed especially for mobile radiotelephones and destroy respectively influence the possibility for having a telephone call by interfering the existing networks. Because a lot of buildings/areas to be protected are settled in build up areas, such a solution will not be accepted by the operating company. After all outside of the guarded buildings or the same telephony shall be possible undisturbed.

An exact radio-engineered limitation of the area isn´t practically possible due to the properties of the spreading of radio transmissions.

Another group of devices are radiogoniometer (for example Rhode und Schwarz, digital direction finding device DDF0xS). They make it possible in an undisturbed relay line section without multiple way reception to determine the direction, from which a radio transmission (als wanted or as side effect) comes.

Radiogoniometry is a well known method for localisation of radio transmitters. But it will only works correct in an area with undisturbed spreading (free field). Furthermore it is only possible via costly additional procedures, in addition to direction measuring to carry out a distance measuring (and therefore an exact measuring on the spot).

For the described application it isn´t possible to start from the fact of an undisturbed spreading. Rather modern radio transmission systems (especially in higher regions of frequency, for example GSM, DECT, Tetra) depend on the utilization of reflec-

tions, diffraction and so on. Generally high frequency emitting devices are located in build up areas, in buildings or airplanes and so on with the effect of multiple way reception. Therefore it is possible that an radio transmitting device is located in a totally different direction as the result of the radiogoniometry (published for example in "Proceedings of the 8th IEEE Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 97), page 95-99). A radiogoniometry alone doesn't therefore meet the requirements.

Last but not least there are devices known, which measure the location of a high frequency emitting device by means of runtimes (company Cell-Loc. Inc./ device Cellocate). These devices are still rather inaccurate (accuracy is stated to be at 125 m in 67% of the measurements).

The localisation solely by means of runtimes is still to inaccurate and in any case problematically in the case of multiple way reception.

Because of this at the moment there is no solution available, that makes possible a fast and localized measurement of an unwanted radio transmission without huge effort of measurement and personal.

Object of this invention is therefore to make possible a fast and locally specified measurement of unwanted radio transmissions.

The solution of the object according to the invention results with respect to the procedure from the characterising features of claim 1 in accordance with the features of the pre-characterising part as well as with respect to the device from the features of claim 24. Further advantageous embodiments of the invention result from the dependent claims.

This invention depends on a method for the uncoverage and the local enclosure of unwanted radio transmissions, for example unwanted telephony with mobile radiotelephones, in which with at least one radio receiver with an antenna, which can be influenced in respect of the receiving properties of the antenna, examines a surrounding area of the radio receiver for the existence of radio transmissions. Such a method will be improved in that way, that as a starting point at least one initial training phase is carried out, during which by means of changing locally allocation between a reference emitting device for radio transmissions and the radio receiver representations of emitted and locally known reference radio transmissions are recorded. These representations picked up during the initial training phase allow an allocation of the local position of the reference radio

transmissions transmitting reference emitting device, which during the later procedure of the method make possible a comparison between radio transmissions not emitted by the reference emitting device and those of the reference emitting device. Therefore at least one measurement phase is carried out, during which the surrounding area is scanned by the radio receiver for the existence of unwanted radio transmissions and by recognition of unwanted radio transmissions a representation of the unwanted radio transmissions is determined. This scanning and recording of the representation of the unwanted radio transmissions serves on the first hand for determining the existence of unwanted radio transmissions and on the other hand by usage of the representation of the unwanted radio transmissions in a later step of the method in an evaluation phase for the comparison between the representations taken up in the initial training phase and the representation of the unwanted radio transmissions and determining thereof it an information of the local position of the unwanted radio transmission in the surrounding area. By the comparison of the representation of the unwanted radio transmission and the representation of the reference radio transmissions it is possible to conclude by different criteria, which of the representations of the reference radio transmissions comes closest to the unwanted radio transmission and to make a statement, where the emitting device of the unwanted radio transmission will probably be located. Herewith in this application as representation of the reference radio transmissions respectively of the unwanted radio transmissions all three-dimensional and/or in time dissolved physical characteristic quantities or signals shall be understood, which can allow any statement about the radio transmissions. Herewith such representations can be constituted for example from any characteristic quantities for the radio transmissions, which can for example be obtained by a receiver device as the characteristic quantities power, frequency respectively modulation or of course every other characteristic quantity known in high-frequency engineering. So it is possible to depict the signal amplitude of the radio transmissions in correlation to the azimuth and perhaps in correlation to the elevation. The term representation of the radio transmissions shows not only these obvious contents of term, but it is also explicitly indicated, as still shown for different preferable embodiments, that for the support of the locally enclosure further features of the signals, for example features in time as signal runtimes and so on can also be brought in for evaluation of the term representation of the radio transmissions.

The novel method therefore is structured in an initial training phase, two measuring phases and the evaluation. In the initial training phase the whole receiving area is scanned (fast) by pivoting the directional antenna for finding unwanted radio transmissions. Because in the interesting area no radio transmissions (of the checked kind) are allowed, the hit frequency is rather small. Has a radio transmission been found, as a rule only one device is involved. It is possible in one preferably embodiment to screen the radio transmission of this device in a second measuring phase with the solution of the directional antenna. Hereby evolves an one-dimensional or two-dimensional representation of the unwanted radio transmission. The features of this representation give information for the local position of the device. Therefore in an initial training phase a representation of each room/ interesting area was taken up (that means the one-dimensional/two-dimensional representation of the radio transmission for a device of the checked kind in this area). Because the arrangement of the rooms/ interesting areas generally not changes, it is possible to find a correlation preferably with the methods of image analysis/ pattern recognition. This correlation will own a certain degree of reliability.

Therefore a radio receiver can be used, which has at his disposal a directional antenna, in which the directive efficiency is controllable about the whole or at least a part of the total ball surface surrounding the receiving device. The three-dimensional resolution of the receiving device is also influencable. As a method therefore it is possible to swivel the receiving lobe or to swivel the receiving minimum or the use of another method of radiogoniometrical techniques. Also it may be possible, that the the change of the directive efficiency of the receiving device is carried out mechanically or electrically or by another known method.

For carrying out the comparison of the representations of the reference radio transmissions coming from the initial training phase with the representation of the unwanted radio transmission if an unwanted radio transmission is acknowledged the measuring signals are in further development transmitted during a secondary measuring phase to an evaluation device, in which the measuring signals are evaluated to an one-dimensional or a two-dimensional representation of the radio transmission. In this evaluation device in a preferably embodiment the representation of the unwanted radio transmission and the representations recorded during initial training phase are compared with each other for correspondences, in which in a preferably embodiment the comparison is carried out

by methods of pattern recognition and/or image analysis. Such methods are well known for the expert and shall therefore not be explained in detail. It shall be called attention to the fact, that also methods of fuzzy techniques can be taken into consideration.

In a preferably embodiment it is an objective of the comparison, that the representation recorded in the initial training phase, which comes closest to the representation of the radio transmission, as well as the local position of the reference radio transmission known by the initial training phase are used as information for the local position of the emitting device of the unwanted radio transmission in the surrounding area. Therefore the representation of the reference radio transmission coming closest to the representation of the unwanted radio transmission is elected and the corresponding information about the local position of the reference radio emitting device during the recording of the reference radio transmission is taken as a probable position also for the emitting device of the unwanted radio transmission. Such an evaluation can use in a preferably embodiment also additional information coming from the representation, as for example time features, signal runtimes, time offset while channel switching or the like. In this way the distance can be roughly estimated for e.g. cellular phones by the time offset between the organisational channel of the involved base station and the radiation of the radio emitting device. Hereby a further dimension can be fit in the method for pattern recognition. By means of further characteristic quantities the pattern recognition can be transferred to a n-dimensional method of evaluation.

In case of detecting of an unwanted radio transmission and if the local position of the unwanted radio transmission can be determined by this evaluation method an alarm is released and operating personnel or the like can well-aimed search in the determined three-dimensional areas for the existence and the owner of an emitting device and stop the usage. Hereby in a preferably embodiment it is possible that while determining radio transmissions in areas, which are surveyed, but in which radio transmission is principally allowed (e.g. outside of the surveyed area), such an alarm is suppressed from the beginning, so that an alarming of the operating personnel happens only if probably an emitting device is located within the surveying area in inadmissible areas.

In the non probable case of recognising multiple simultaneous radio transmissions by a special treatment during evaluation a result can also be achieved (even though not such a good). The overlay areas outside the guarded area, in which a radio transmission is

allowed and which can´t be avoided because of radio-engineering restrictions, belong also to the interesting areas. Is the device located in these areas, no (spurious) alarm is triggered.

For supporting the local determination additional features of the signal (e.g. features of time) are usable. In this way the distance can be roughly estimated for e.g. cellular phones by the time offset between the organisational channel of the involved base station and the radiation of the radio emitting device. Hereby a further dimension can be fit in the method for pattern recognition. By means of further characteristic quantities the pattern recognition can be transferred to a n-dimensional method of evaluation.

As methods of pattern recognition fuzzy techniques can be employed, because the problem of measuring is per se "blurred".

The (measuring) receiver can be moved on a known path. During this path the patterns of the respective position of receiving are used.

The results can be improved by means of several receiving configurations (a plurality of receivers or diversity receiving) and a common evaluation.

By means of a respective sensitive measuring receiver (this is supported by the directive efficiency of the antenna) for the special case radiotelephony so-called cellular phones can be located, which work solely in the so-called stand-by mode. In this case the different signal/frequency structure can be taken into consideration. Cellular phones in the so-called stand-by mode are often clock-pulsed in respect of their reception state for extending the duration of the usage time of their accumulators. The signal of the clock-pulse controlled switching online or offline the receivers can also be used.

By means of a respective sensitive measuring receiver (this is supported by the directive efficiency of the antenna) for the special case of determining unwanted radio transmissions of devices not conceived therefore (so-called notebooks, CD-players or the same) also their poor emission can also be registered and locally determined.

Using the described method it is possible for the first time to locally determine unwanted radio transmissions within an observation area relatively exact and at favourable conditions. This is possible despite of the multiple way transmission in the described applications. Such a tracking down assumed by this time a measuring with a lot of personnel with special measuring devices and making conclusions by trained experts in radio transmissions. Because of the initial training phase the necessity of experts exists – even at all – only during the initial train-

ing phase. After this the device can be handled by semi-skilled personnel coming from the respective institution, which will be surveyed. Therefore a surveillance is possible around the clock at very favourable conditions.

By means of the nowadays very efficient digital techniques the algorithm of pattern recognition can be carried out on a standard computer. Electronically adjustable antennas get a mass product because of their arising usage in radio telephony networks and get also cheaper. The same counts for HF receiver. Therefore it is possible to save costs for personnel and also to base on acceptable costs for the devices.

Enbodiments for the application of the novel method are shown in the figures and are described in the following passages.

Very preferable applications according to the inventive method and the device show the figures:

Fig. 1 - surveillance of a building from outside (jail),
Fig. 2 - surveillance of an airplane,
Fig. 3 - surveillance of a building from inside (hospital).

In the application of the example according to figure 1 the front side 1 of a building of a jail is kept under surveillance by means of a single measuring receiver 2. The reciever 2 stores during an initial training phase for each cell 3 that pattern/those patterns, which arise during carrying out telephony inside of this cell 3. By means of pattern recognition it is possible to recognise this pattern for example in cell 6 during unallowed usage of a cellular phone and determining this pattern with a certain probability to this cell 6. Hereby multi way receiving (indicated by the two arrows 4 respective 5) must be dealt with.

An allowed radio telephony 7 outside the building 1 can because of reflections at the front side of the building 1 of the jail result in a radio receipt corresponding to the way of the signal 5 from the direction of the jail. Because of obstacles 8 (e.g. trees with leaves) the direct path between cellular phone of the allowed radio transmission 7 and receiver 2 (line of sight) can be blocked. A simple method for direction finding would cause wrong results. The two-dimensional pattern of the reflected radio transmission 4 differs however from the patterns of the radio transmissions 5 coming from cell 3. Therefore the allowed radio transmission 7 can be recognized as such and no alarm will be triggered.

Because of seasonal changes in the surrounding (e.g. because of leaves of trees) in this constellation a seasonal conditioned training phase for the patterns would be used. Also a new initial training phase in suitable time steps could be inserted.

After recognizing an unallowed radio transmission the personnel of the jail can purposeful search for the emitting device in the cell 3/in the cells 3 because of the local determination.

In the application of the example according to figure 2 an airplane is kept under surveillance by means of a two measuring receivers 2, 9. The receivers 2, 9 store during an initial training phase for every seat 13 respective every row of seats 10 that pattern/those patterns resulted by radio transmission coming from there. Hereby the patterns must generally be stored in respect of the frequency. This is necessary, because in the airplane the unwanted radio transmissions 12 coming from devices (cellular phones in stand-by mode, notebooks and so on) can vary in a wide frequency band. By means of pattern recognition it is possible to recognise this pattern during a unallowed radio transmission 12 and to determine this pattern with a certain probability to a certain row 10 of seats/ a certain seat 13. In this example two receivers 2, 9 are used for purposes of improving sensitivity and resolution of local position. Hereby multi way receiving (indicated by the arrows 12) must be dealt with.

Because of slight changes of the surrounding in accordance to the reservation of every flight the pattern recognition must act flexible, e.g. by using fuzzy techniques.

After recognizing an unallowed radio transmission 12 the cabin personnel can purposeful search/ask for the device after the local determination (hatched area 14).

In the application of the example according to figure 3 an area 16 to protect within a building (here e.g. a hospital) is kept under surveillance by means of a single measuring receiver 2. The reciever 2 stores during an initial training phase for enough spots in the area 16 to protect (and perhaps also for comparison enough spots of the allowed area 15) that pattern/those patterns, which arise during radio transmissions 19, 20 from this spot/these spots. Hereby the patterns must generally be stored in respect of the frequency. This is necessary, because in a hospital the unwanted radio transmissions 19, 20 coming from devices (cellular phones in stand-by mode, notebooks and so on) can vary in a wide frequency band. By means of pattern recognition it is possible to recognise this pattern during a unallowed radio transmission 19, 20 and to determine this pattern with a certain probability to a certain spot within the area 16 to protect or within the allowed area 15. Hereby multi way receiving (indicated by the arrows 19, 20) must be dealt with. The direction is here also not a sufficient indication for the origin of the radio transmissions 19, 20, instead the pattern has to be taken into consideration.

Because of changes of the surrounding in accordance to the audience times, objects in the floors and so on the pattern recognition must act flexible, e.g. by using fuzzy techniques.

After recognizing an unallowed radio transmission 19 the responsible staff (e.g. floor nurse) can purposeful search/ask for the device after the local determination.

List of Reference Numbers

	1	-	front side of building
	2	-	reciever
	3	-	cell
5	4	-	path of signal
	5	-	path of signal
	6	-	unallowed radio transmission in cell
	7	-	allowed radio transmission outside the cell
	8	-	obstacle
10	9	-	reciever
	10	-	rows of seats
	11	-	fuselage
	12	-	path of signal
	13	-	seat
15	14	-	determined position/area
	15	-	area with allowed radio transmission
	16	-	area with unallowed radio transmission
	17	-	emitter
	18	-	emitter
20	19	-	path of signal
	20	-	path of signal

Claims

1. Method for the uncoverage and the local enclosure of unwanted radio transmissions (5, 12, 19), for example unwanted telephony with mobile radiotelephones, in which with at least one radio receiver (2) with an antenna, which can be influenced in respect of their receiving properties, a surrounding area of the radio receiver (2) is examined for the existence of radio transmissions (5, 12, 19),

   characterized in that

   after at least one initial training phase, in which by means of changing locally allocation between a reference emitting device for radio transmissions (5, 12, 19) and the radio receiver (2) representations of emitted and locally known reference radio transmissions are recorded,

   at least a first measurement phase is carried out, during which the surrounding area is scanned by the radio receiver (2) for the existence of radio transmissions (5, 12, 19) of unwanted emitting devices (6, 13, 17) and by recognition of unwanted radio transmissions (5, 12, 19) a representation of the unwanted radio transmission (5, 12, 19) is determined,

   during existence of unwanted radio transmissions (5, 12, 19) an evaluation phase follows, in which the representations recorded during initial training phase and the representation of the recorded radio transmissions (5, 12, 19) are compared with each other and there from an information about the local position of the emitting device (6, 13, 17) of the unwanted radio transmissions (5, 12, 19) in the surrounding area is evaluated.

2. Method as claimed in claim 1, **characterized in that** a first measuring phase is carried out, during which the radio receiver (2) scans the surrounding area fast and with less accuracy for the existence of unwanted radio transmissions (5, 12, 19).

3. Method as claimed in one of the claims 1 or 2, **characterized in that** the surrounding area is scanned totally or partially by the radio receiver (2) for unwanted radio transmissions (5, 12, 19).

4. Method as claimed in claim 1, **characterized in that** after the recognition of an unwanted radio transmission (5, 12, 19) a second measuring phase is carried out, during

which the registered unwanted radio transmission (5, 12, 19) is measured with more accuracy.

5. Method as claimed in claim 4, **characterized in that** the recognized unwanted radio transmission (5, 12, 19) is measured with higher resolution of the radio receiver (2).

6. Method as claimed in claim 5, **characterized in that** the recognized unwanted radio transmission (5, 12, 19) is measured with higher resolution by a change of the directive efficiency of the radio receiver (2).

7. Method as claimed in one of the above mentioned claims, **characterized in that** the measurement signals of the secondary measurement phase at registering an unwanted radio transmission (5, 12, 19) phase are transmitted to a evaluation device, in which the measurement signals are evaluated in form of a one-dimensional or two-dimensional representation of the radio transmission (5, 12, 19).

8. Method as claimed in claim 7, **characterized in that** the representation of the radio transmission (5, 12, 19) is compared for correspondences with the representations recorded in the initial training phase.

9. Method as claimed in one of the claims 7 or 8, **characterized in that** the comparison of the representation recorded in the initial training phase and the representation of the radio transmission (5, 12, 19) is carried out by means of methods of pattern recognition and/or image analysis.

10. Method as claimed in one of the claims 7 to 9, **characterized in that** as methods of pattern recognition and/or image analysis fuzzy techniques are employed.

11. Method as claimed in one of the claims 7 to 10, **characterized in that** the representation recorded in the initial training phase, which comes closest to the representation of the radio transmission (5, 12, 19), as well as the local position of the reference radio transmission known by the initial training phase are used as information for the local position of the emitting device (6, 13, 17) of the unwanted radio transmission (5, 12, 19) in the surrounding area.

12. Method as claimed in claim 11, **characterized in that** in case of evaluation of the local position of the emitting device (6, 13, 17) of a unwanted radio transmission (5, 12, 19) in a part of the surrounding area, in which radio transmission are unwanted, the evaluation device automatically alarms the operating personnel.

13. Method as claimed in claim 11, **characterized in that** in case of evaluation of the local position of the emitting device (6, 13, 17) of a unwanted radio transmission (5, 12, 19) in a part of the surrounding area, in which radio transmission are tolerated, the alarm for the operating personnel is suppressed.

14. Method as claimed in one of the claims 7 to 13, **characterized in that** the closest representation recorded during the initial training phase and the representation of the unwanted radio transmission (5, 12, 19) are examined for the degree of correspondence by means of different features.

15. Method as claimed in one of the claims 7 to 13, **characterized in that** additional information coming from the unwanted radio transmission (5, 12, 19), preferably signal runtimes, time offset while channel switching or the like, are used as further information during evaluation of the signals of the radio receiver (2) in the evaluation device.

16. Method as claimed in one of the above mentioned claims, **characterized in that** the signals of more than one radio receiver (2) are evaluated in the evaluation device and are connected to a common representation of the radio transmission (5, 12, 19).

17. Method as claimed in one of the above mentioned claims, **characterized in that** for common radiotelephony devices, so-called cellular phones, for the evaluation of the representation also the radio transmissions (5, 12, 19) of such radiotelephony devices in the so-called stand-by mode are used for determining the local position of the radiotelephony device.

18. Method as claimed in claim 17, **characterized in that** for determining the local position of such radiotelephony devices in the so-called stand-by mode the radio transmissions (5, 12, 19) of the clock-pulse controlled switching online or offline the receivers of the radiotelephony devices is used.

19. Method as claimed in one of the above mentioned claims, **characterized in that** the method also serves for determining the local position of unspecific radio transmissions (5, 12, 19) of common electrotechnical devices, preferably so-called notebooks, CD-players or the same, which set free noise fields of a high frequency kind.

20. Method as claimed in one of the above mentioned claims, **characterized in that** at recognising multiple simultaneous radio transmissions (5, 12, 19) of different unwanted

emitting device (6, 13, 17) a special treatment of the measurement signals of the radio receiver (2) is carried out, in which the signals are treated separately.

21. Method as claimed in one of the above mentioned claims, **characterized in that** the radio receiver (2) and/or the reference emitting device are moved on a respective to their position known path during the initial training phase and the radio receiver (2) records at known spots of this path reference radio transmissions.

22. Method as claimed in one of the above mentioned claims, **characterized in that** the initial training phase is carried out unique or after longer time intervals und the so developing representations of typical radio transmissions (5, 12, 19) are stored.

23. Method as claimed in claim 22, **characterized in that** the initial training phase is carried out each time, when the conditions of the surrounding area of the radio receiver (2) have changed significantly, preferably have changed seasonal.

24. Device for the uncoverage and the local enclosure of unwanted radio transmissions (5, 12, 19), for example unwanted telephony with mobile radiotelephones, especially for implementation of the method according to claim 1, showing at least one radio receiver (2) with a receiving device, which can be influenced in respect of their receiving properties,
characterized in that
the receiving device shows a directional antenna.

25. Device as claimed in claim 24, **characterized in that** the radio receiver (2) is influencable in his directive efficiency and/ or his resolution.

26. Device as claimed in one of the claims 24 or 25, **characterized in that** the directive efficiency of the receiving device is controllable about at least a part of the total ball surface surrounding the receiving device.

27. Device as claimed in one of the claims 24 to 26, **characterized in that** the change of the directive efficiency of the receiving device is caused mechanically or electrically.

28. Device as claimed in one of the claims 24 to 27, **characterized in that** the change of the directive efficiency is influencable by a swivel of the receiving lobe or of the receiving minimum or by a method of radiogoniometrical techniques.

29. Device as claimed in one of the claims 22 to 28, **characterized in that** the radio receiver (2) is coupled by signals with an evaluation device, to which the signals of the received unwanted radio transmissions (5, 12, 19) are transmitted.

30. Device as claimed in claim 29, **characterized in that** when several radio receivers (2) are used all signals of the received unwanted radio transmissions (5, 12, 19) are transmittable to a common evaluation device.

31. Device as claimed in one of the claims 29 or 30, **characterized in that** the evaluation device is build by usage of a standard computer or the same.

Summary

The invention relates to a method for the uncoverage and the local enclosure of unwanted radio transmissions (5, 12, 19), for example unwanted telephony with mobile radiotelephones, in which with at least one radio receiver (2) with an antenna, which can be influenced in respect of their receiving properties, a surrounding area of the radio receiver (2) is examined for the existence of radio transmissions (5, 12, 19), namely after at least one initial training phase is carried out, during which by means of changing locally allocation between a reference emitting device for radio transmissions (5, 12, 19) and the radio receiver (2) representations of emitted and locally known reference radio transmissions are recorded, and afterwards at least a first measurement phase is carried out, during which the surrounding area is scanned by the radio receiver (2) for the existence of unwanted radio transmissions (5, 12, 19) and by recognition of unwanted radio transmission (5, 12, 19) a representation of the unwanted radio transmission (5, 12, 19) is determined, during existence of unwanted radio transmissions (5, 12, 19) an evaluation phase follows, in which the representations recorded during initial training phase and the representation of the recorded radio transmissions (5, 12, 19) are compared with each other and there from an information about the local position of the emitting device (6, 13, 17) of the unwanted radio transmissions (5, 12, 19) in the surrounding area is evaluated.

(Fig. 1)

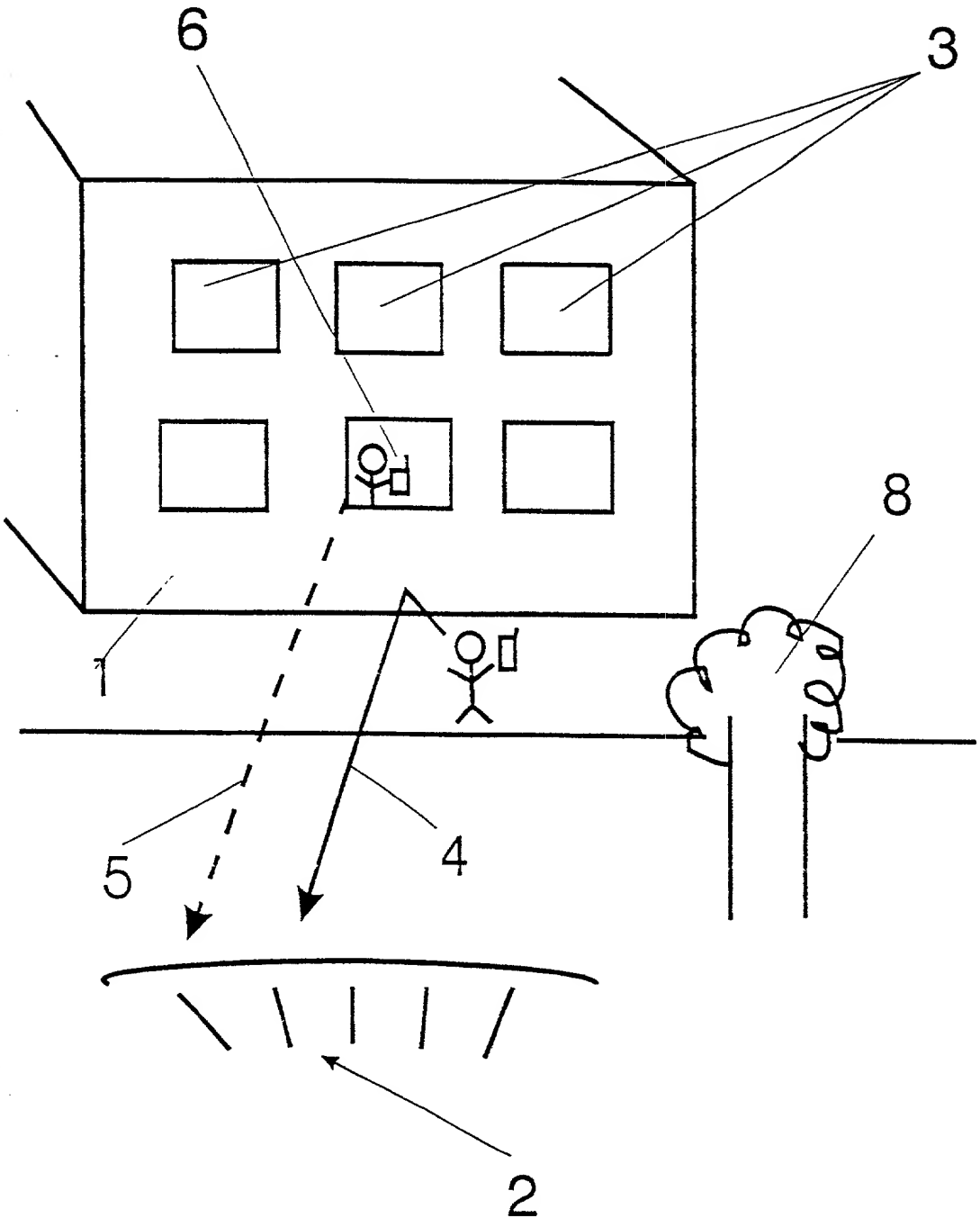

Fig. 1

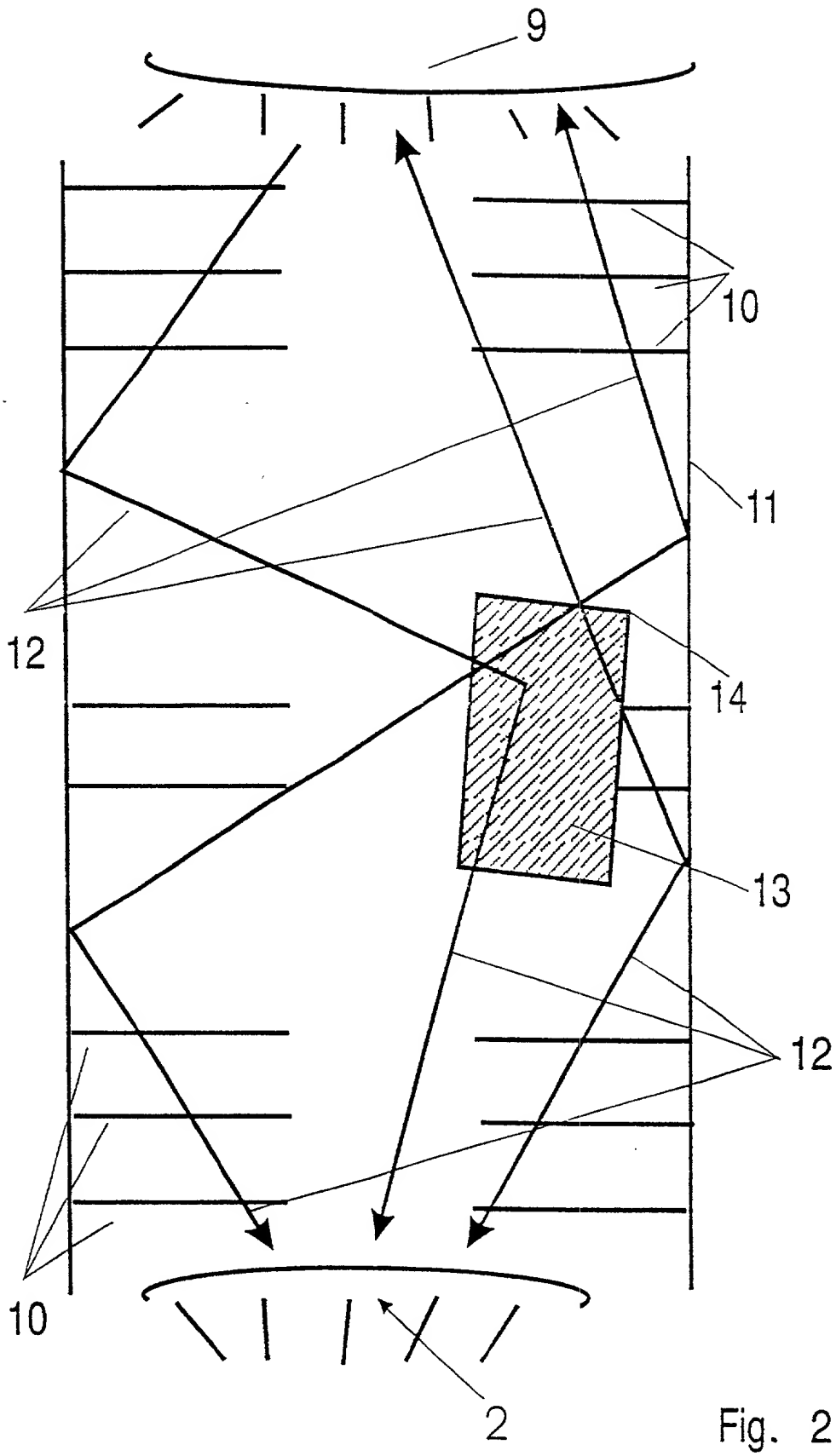

Fig. 2

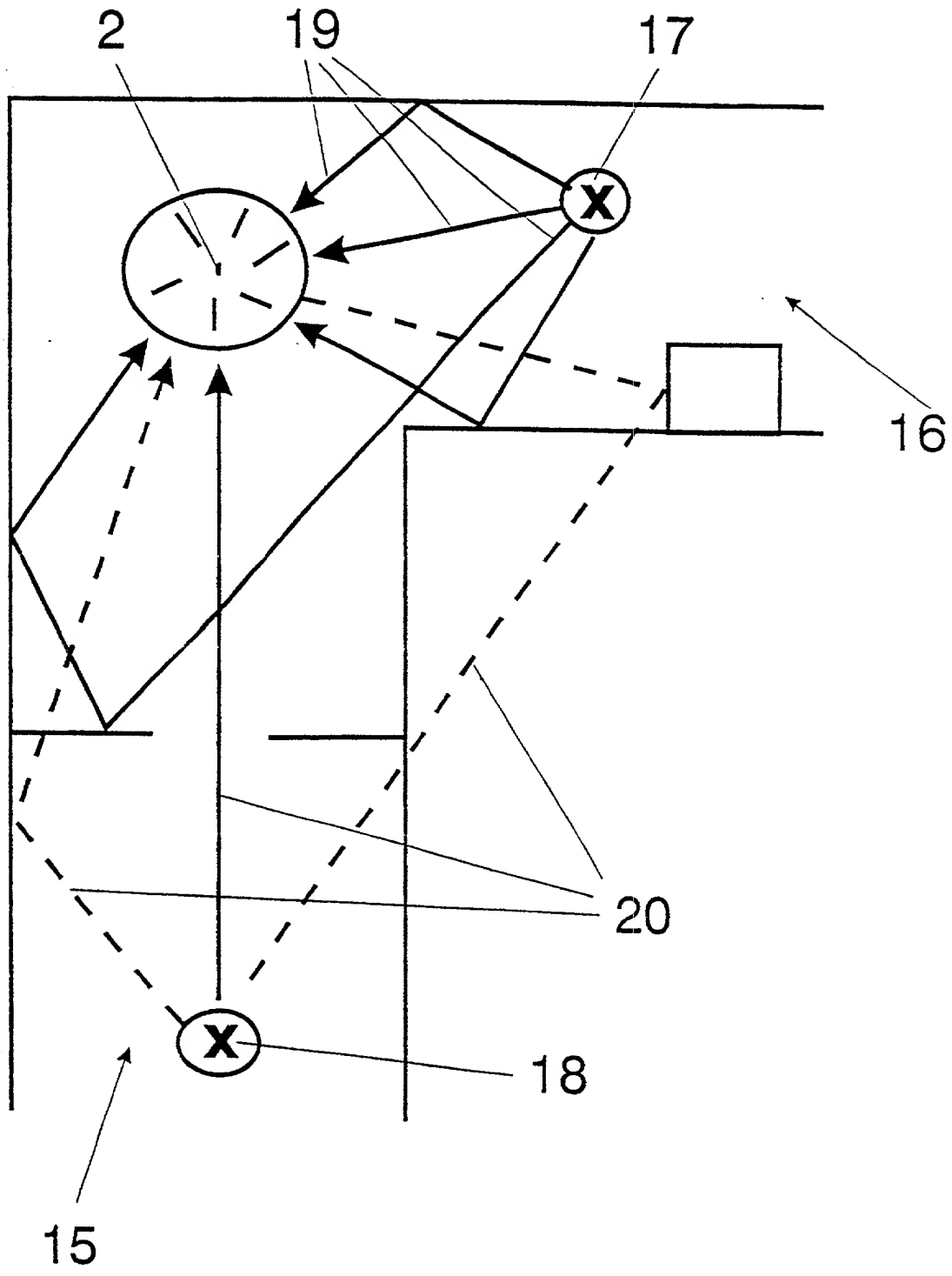

Fig. 3

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER
MANSEL-PCT

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application Number) (Filing Date)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclose in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check One)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.

PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration numbers): KURT KELMAN, Registration No. 18,628
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2	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202
Detlef Mansel	
DATE: 10th of May 2001	DATE

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER
MANSEL-PCT

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND DEVICE FOR DISCOVERING AND LOCALIZING UNDESIRABLE RADIO EMISSIONS

the specification of which (check only one item below):

[ ] is attached hereto.

[ ] was filed as United States application
Serial No. ______________________
on ______________________,
and was amended
on ______________________ (if applicable).

[X] was filed as PCT international application
Number PCT/DE99/03620
on 14 NOVEMBER 1999,
and was amended under PCT Article 19
on ______________________ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
GERMANY	198 52 715.2	16 NOVEMBER 1998	[X] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO